

## **INTRODUCTION**

**John H. Nuckolls**  
**Associate Director at Large, LLNL**

A Planetary Defense Workshop (PDW) on the detection and mitigation of hazardous asteroids and comets was held at Lawrence Livermore National Laboratory, May 22-26, 1995. More than 100 scientists and engineers participated. This was one of several recent conferences on this subject.\*

The PDW Organizing Committee included Dr. Gregory Canavan, Los Alamos National Laboratory; Dr. Eugene Shoemaker, U.S. Geological Survey; Dr. John E. Mansfield, NASA Associate Administrator for Space Access and Technology; Mr. John H. Darrah, Chief Scientist, HQ AFSPC/CN; Dr. Stewart Nozette, BMDO/USAF; Prof. Vadim A. Simonenko, Deputy Scientific Leader, Russian Federal Nuclear Center - VNIITF, Chelyabinsk-70; and Dr. Robert B. Barker, Assistant to the Director, LLNL. These members assisted me in organizing the workshop, and chaired the five major topical sections: Threat (chaired by Dr. Shoemaker), Detection (Mr. Darrah), Experiments (co-chaired by Drs. Mansfield and Nozette) Interdiction (Prof. Simonenko and Dr. Barker), and Integration (Dr. Canavan). Mrs. Shirley Petty, LLNL, was PDW Administrator.

Dr. Canavan proposed an integrated program for detecting and mitigating hazardous near-Earth objects. Proposed USG funding is substantially less than current expenditures to mitigate and respond to natural disasters involving comparable life-loss on the time - average (e.g., that due to hurricanes, large floods, and earthquakes, etc.). There is strong support in the scientific communities represented at the PDW for increased effort to detect hazardous comets and asteroids. There is agreement that a significant threat exists, detection is feasible, and mitigation is often possible.

Major issues are: Will governments principally focused on obvious and pressing problems initiate and sustain a long-term commitment to search for threats from space and prepare for their mitigation? Will detection of a specific comet or

---

\* Earlier conferences included: April/May '91, at San Juan Capistrano (organized by NASA Ames); Jan. '92, at Los Alamos (organized by LANL/NASA); Jan. '93, at Tucson (organized by University of Arizona); Sept. '94, at Chelyabinsk, Russia (organized by VNIITF, Russian Federal Nuclear Center); and April '95, at the United Nations.

asteroid on a collision course with Earth be required to catalyze rational government actions?

One or more of the thousands of Earth orbit crossing objects carrying  $\geq$  gigaton energies may pass within several diameters of Earth in the lifetimes of our children. Millions of casualties would result in the unlucky event that one of these gigaton objects crashed into Earth's oceans, creating multi-continent-impacting super tsunamis, or exploded near major population centers. Governments may decide to begin near term deflection of hazardous objects predicted to pass near Earth in the distant future because there are significant uncertainties in long-term orbit calculations, and mitigation is less costly and more likely to succeed if performed as far in advance as possible (ideally many decades before close approach to Earth). A near-term goal should be to identify potentially hazardous asteroids and comets which will pass within several diameters of Earth in the 21st Century. This is technically feasible and relatively inexpensive.

Edward Teller participated in the Planetary Defense Workshop (as well as in the earlier conferences at Chelyabinsk and Los Alamos). He provided a broad perspective on detection and mitigation of the threat, and emphasized the need for experiments to determine the composition and structure of comets and asteroids. He also discussed a strategy for mitigating hazardous objects so large as to be beyond the capabilities of nuclear explosive-based means.

Summaries by Organizing Committee members of the five major topical sections comprise the core of this Executive Summary. Opinions and conclusions are those of the authors.

More than 50 papers presented at the PDW provide the main body of this Proceedings. They are organized into five topical sections, including papers presented in the plenary sessions which opened the PDW.

The LLNL PDW Proceedings is available on the net:  
<http://www.llnl.gov/planetary>. For further information, contact PDW Administrator, Mrs. Shirley Petty, at [petty2@llnl.gov](mailto:petty2@llnl.gov).